

ABSTRACT

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Title: Strategies For Low-Risk Tailoring Of Thermal and Structural Reliability Test Standards

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Abstract: The Jet Propulsion laboratory has developed an array of reliability test standards and practices based on theoretical considerations and accumulated spaceflight experience. These standards, of necessity, are conservative and often general in nature, but can be tailored to the requirements of each new mission. Long-life planetary missions, from which most of the standards were derived, best fit the general pattern of tests. This experience base is used as a starting point in the development of the specific reliability program for each new JPL mission.

The standardized tests are often the least expensive and most direct way to develop the required confidence in achieving the mission objectives. As spacecraft designs, mission objectives, and program constraints evolve, these standardized techniques must be reexamined for each new mission. The degree of conservatism in a standard test program often can be reduced without an appreciable increase in risk if the key reliability features are understood and preserved.

In this paper three examples of tailoring are reviewed to illustrate this tailoring process. Two examples are related to thermal testing and one to dynamic testing. The first thermal tailoring

example is a variation of the standard thermal-vacuum testing which is designed to reduce the cost of testing by deleting the vacuum requirement. The other thermal technique outlines how the highest test temperatures can be reduced by extending the test duration while maintaining the same level of reliability confidence. This provides a design flexibility which permits the use of materials or components which may be degraded at the upper standard temperature extremes.

The third example of tailoring illustrates the use of a new improved dynamic testing method. In time the standard tests may evolve to incorporate this new technique but early tailoring the standard tests are advisable until sufficient experience is accumulated to confidently revise the standards. The method simultaneously controls both the acceleration and force at the interface between the shaker and the tested item rather than the acceleration alone. This significantly improves the fidelity of the dynamic simulations and avoids the need for an overly conservative structural design in order to survive the standard test profiles. This particular tailoring method becomes increasingly significant for the smaller lightweight spacecraft missions anticipated in the future.

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